Studies in the Spirituality of Jesuits

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"Nature Is a Heraclitean Fire"

Reflections on Cosmology in an Ecological Age

David S. Toolan, S.J.

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David S. Toolan, S.J.

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23/5: November 1991

For your information . . .

Readers of Gerard Manley Hopkins's poetry will recognize the title of the essay for this issue of *Studies*. It comes from the title of his great poem "That Nature Is a Heraclitean Fire and of the Comfort of the Resurrection."

It is one of the last half dozen poems that Hopkins wrote; and its last words, which refer to the risen Christ and to man and woman redeemed by Christ, are "immortal diamond." Those very words are on the memorial to him in the Poets' Corner of Westminster Abbey. The Greek philosopher Heraclitus is supposed to have called the soul "a spark of the substance of the stars," and this essay ranges from the physics of the stars to the beauty of the *Duino Elegies* of that wonderful German poet, Rainer Maria Rilke. I think you will find this *Studies* essay unusually informative, thought-provoking, and, indeed, in every best sense of the word, poetic.

This will be the last time that the logo which has appeared on the back of the copies of *Studies* during the past two years will be there, the logo commemorating the founding of the Society of Jesus in 1540 and the birth of St. Ignatius in 1491. In the course of those two years in which we celebrated those two anniversaries, *Studies* has published a series of issues that included a bibliography on St. Ignatius's *Spiritual Exercises* and essays on the Spiritual Exercises in everyday life and in the experience of a weekend retreat. We have also published essays on Jesuit spirituality from a process perspective, and in relationship to several distinctive characteristics of Jesuit life and work. Those subjects have included discernment, the ministry of the intellectual life, ministering to the young, the process of Jesuit formation, and the mental health of the members of the Society itself. This last issue of the Ignatian year, in reflecting on cosmology in our ecological age, gives us an opportunity to look in a new way on the scene of all our lives and all those works, this very world itself, created by God, redeemed by Christ, the theater of our actions, and the testimony to the love of God "working in all creation."

To turn from the "sublime" to what may be pedestrian but necessary, the annual subscription for *Studies in the Spirituality of Jesuits* and the cost of individual copies will increase beginning with the January

1992 issue. The four central "P's" in publishing—paper, printing, postage, and personnel—have risen inexorably in cost over the last year and give every prospect of continuing to do so into the future. The details of those changes in subscription prices and individual-issue prices are to be found on the inside back cover of this present issue of *Studies*.

Finally, the Institute of Jesuit Sources has just published its latest catalog. It includes special notices of new, recent, and forthcoming books, and it lists all of the IJS publications. Regular recipients of *Studies* will receive a copy in the mail; if anyone wishes further copies to send to friends, something which I heartily encourage, just write to me here at the Seminar on Jesuit Spirituality or at the Institute of Jesuit Sources. The address is the same for both: 3700 W. Pine Blvd., St. Louis, MO 63108.

John W. Padberg, S.J.

Editor

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From the beginning till now the entire creation, as we know, has been groaning in one great act of giving birth.

—Rom. 8:22

There will be a revival of Christianity when it becomes impossible to write a popular manual of science without referring to the incarnation of the Word.

—Owen Barfield

Nobody, I think, can fail to see that the vital question for Christianity today is to decide what attitude believers will adopt towards this recognition of the value of the Whole, this preoccupation with the Whole.

—Pierre Teilhard de Chardin

"Nature Is a Heraclitean Fire"

Reflections on Cosmology in an Ecological Age

Introduction

A little over a year ago, a very interesting news release passed across my desk at *America*. It was a letter from twenty-four distinguished scientists, among them Carl Sagan, Hans Bethe, Freeman J. Dyson, and Stephen Jay Gould. In their letter, entitled "Preserving and Cherishing the Earth: An Appeal for Joint Commitment in Religion and Science," the signers acknowledged that behind all their dispassionate investigation of quarks and protozoa lay another kind of motivation. "As scientists," they wrote, "many of us have had profound experiences of awe and reverence for the universe." What worried them were the massive, man-made "environmental alterations about whose long-term biological and ecological consequences we are still painfully ignorant." "We understand," they said, "that what is regarded as sacred is more likely to be treated with care and respect. Our planetary home should be so regarded. Efforts to safeguard and cherish the environment need to be infused with a vision of the sacred." Hence, "we scientists . . . urgently appeal to the world religious community to commit, in word and deed, and as boldly as is required, to preserve the environment of the Earth."

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It was like getting notice from a group of sorcerer's apprentices whose experiments had gone berserk. Here they were, the very wizards whose ingenuity had created the industrial Frankenstein that is now desecrating the planet, appealing for help from quarters that, since the condemnation of Galileo in 1633, had not been especially friendly to the scientific enterprise. After some four hundred years of disgodding the Earth, they wanted us to re-enchant it again, wanted us, perhaps, to feel the way the Navajo do when they chant

The Earth, its feet are my feet,
The Earth, its legs are my legs,
The Earth, its body is my body,
The Earth, its thoughts are my thoughts,
The Earth, its speech is my speech.

How might American Catholics, Jesuits in particular, I asked myself, lend a helping hand? That was an odd question to ask. I haven't hugged a tree in years. In fact, I live and work in the middle of a constant traffic jam, and my idea of wilderness is the South Bronx. Nonetheless, perhaps just because discord lies all about me, the issue of my connection (or lack of it) to Mother Earth bugs me. So I ask you, How does the universe resonate inside us? And what do we owe the planet in this hour of its trial? The Pope kisses the tarmac every time he steps off a Boeing 707. But we are not Central Europeans. Is the Earth sacred to us?

For Catholics as a whole, the answer to such questions, I shall suppose, will depend on what their twentieth-century imaginations bring to words like those of astronaut Frank Borman as he orbited the Moon for the first time on Christmas Eve, 1968, and read from the Book of Genesis: "In the beginning God created the heavens and the Earth . . . and God's spirit hovered over the water"; and after each day of creation, "God saw that it was good . . . and indeed it was very good" (Gen. 1:1–31). Or what do we bring to the New Testament parallel: "In the beginning was the Word. . . . Through him all things came to be, not one thing had its being but through him" (John 1:1, 3). For Jesuits I shall suppose that in addition the answer will depend on what

we have been making lately of the Contemplation on the Love of God. After Einstein and Stephen Hawking, what do we bring to meditating on "how God dwells in . . . the elements, giving them being; in the plants, giving them growth; in the animals, giving them sensation . . ."? We claim to find God in all things. But in what way do we sense that God "works and labors . . . in all created things" on our behalf? Have we forgotten that we have thirty-four craters of the Moon named after astronomers of our Company? Are we up to date on the new physics and cosmology that seems to have so much of the rest of the population awestruck? If not, this essay will be a modest effort to get us going.[1]

What has happened to our vaunted sacramental consciousness? Why hasn't it sent us into the lists to defend soil, water, air, and the gene pool of tropical forests? (Maybe I'm wrong. Are Catholics already at the forefront—and Andrew Greeley just hasn't told me yet?) Why isn't the Company once graced by Gerard Manley Hopkins and Teilhard de Chardin out ahead on this one as the "ultimate pro-life issue"? Why don't we feel, as the "ecologian" Fr. Thomas Berry does, that in destroying the Earth we forget the "numinous quality of every earthly reality" and "destroy modes of divine presence"?[2] Such questions bring me to the heart of the matter: How do we conceive (or misconceive) our relationship to Earth? In terms of the "myth we live by"—the kind of story that answers the question of who we are and where we are going, that defines our ultimate meaning and destiny—one might guess that the Earth does not much figure. And hence Earth's plight, its Passion story, does not move us to action. The gift of Earth, the sheer wonder of it, I suggest, needs to figure at

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[1] "Our growing sensitivity to ecological problems," writes Walter J. Ong, S.J., ". . . desperately needs theology . . . in an up-to-date cosmological setting." See "God's Known Universe and Christian Faith: Pastoral, Homiletic and Devotional Reflections," *Thought* 66, No. 262 (Sept. 1991): 241–58, esp. p. 257. My essay, though written before seeing Fr. Ong's article, is in many ways a response to it.

[2] Thomas Berry, *The Dream of the Earth* (San Francisco: Sierra Club, 1988), 11.

the center of our liturgy. In the last two parts of this essay, Sections 8 and 9, I will offer a few ideas on how we might reimagine the Eucharist to do that.

The Challenge

1. The Ecological Crisis

But what, precisely, were those anxious scientists asking us and our spiritual leaders to do? Certainly not what scientists, technocrats, politicians, and the Sierra Club can do better. For scientists know, or are ready to find out, what needs to be done to reduce sulphur dioxide emissions that cause acid rain, or to flush the atmosphere of carbon dioxide and chlorofluorocarbons that produce global warming and rip holes in the protective ozone layer. Agronomists are quite capable of redesigning agriculture on the model of nature's own recycling patterns, so that we don't continue to erode and poison precious topsoil with pesticides, chemical fertilizers, and monocrops for export. Economists can also recalculate GNP to measure resource depletion, so that we do not continue to deceive ourselves with bottom-line production rates and per-capita-income measures. And there are ways, short of abortion programs, to control the exponential population growth that is rapidly denuding the planet of its wetlands, forests, and watersheds.

Ecology, moreover, is becoming more of a science every year. Increasingly, ecologists know what not to do. Some years ago, for instance, regional authorities decided they could improve the livelihood of those living around Lake Victoria in Africa by importing the Nile perch. A predatory fish, it promptly annihilated its own food supply, destroyed the local fisheries, and drove the surrounding population to fell their forests in order to smoke the oily and distasteful perch. The experiment, undertaken without regard to the subtle relationships of the local

biological community, was an unmitigated economic and social disaster.[3]

Governments, we may hope, are wising up. In 1982 the United Nations General Assembly adopted the World Charter for Nature, proclaiming that "nature shall be protected and its essential processes shall not be impaired." Closer to home, the pages of the prestigious *Foreign Affairs* and *Foreign Policy* are peppered these days with contributions from experts telling Washington's foreign-policy elite that the major source of geopolitical crisis in the coming decades will be ecological.[4] (Whether anyone is listening is another matter.) But some far-sighted political scientists have a rough idea of the kind of appropriate technology the Third World needs and the new international rules and regulatory agencies that ought to be put in place to ensure a level playing field among nations. In sum, despite the complexity of the matter, the ideas and skills to ensure planetary well-being are already on our computer screens—or soon will be. When it comes to that, scientists and naturalists can probably also do better than religious communities in supplying reasons to feel guilty (and powerless) about the dwindling gene pools of tropical rain forests or the likelihood that the polar ice caps will melt in the next century.

It follows, then, that Carl Sagan and his friends may be asking for something other than moral exhortation from us. Yes, of course, religious groups will have to see that ecology is a moral issue, indeed, perhaps the prime social-justice issue. Jesuits, I assume, will have no trouble making the link: Dehumanizing poverty and environmental degradation go together. The politics of oligarchy drives Indians and peasants from the best arable land and begets a desparate search for tillage; this

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[3] See Robert E. Ricklefs, *Ecology*, 3rd ed. (New York: W. H. Freeman, 1990), 3f.

[4] For instance, see Jessica Tuchman Matthews, "Redefining Security," *Foreign Affairs* (Spring 1989): 162–77. Also Norman Myers, "Environment and Security," *Foreign Policy* (Spring 1989): 23–41.

invariably means laying waste mountainous forest watersheds; the resulting erosion then silts rivers, plays havoc with irrigation, and causes severe water shortages in cities. Or it drives peasants into urban *favelas*. The same dynamic is responsible for the recent flood of Latin American immigration to the ghettoes of this country; it makes it impossible to distinguish those seeking political asylum from "environmental refugees," which is what most of the immigrants are. In any case, I shall take the point as given—that you cannot defend defenseless embryos, have a "consistent ethic of life," or make a "preferential option for the poor" without simultaneously deciding to do justice to the ravaged and defenseless "commons" of the globe: Earth, water, and air.

Naively, our ancestors thought they could take these gifts for granted. We cannot. The 160 billion tons of carbon industry has spewed into the atmosphere since 1860 may not (just yet) disturb our summer vacations. But it is a monumental explosion that threatens over the long run to convert our Earth into something resembling the molten, uninhabitable planet Venus. To counterbalance the five tons of carbon dioxide one American annually puts into the air would require planting 4,500 trees![5] The situation is without parallel. The inventive/destructive human mind, Teilhard de Chardin's noosphere, we must begin to realize, has become a geological force, like a flow of lava, an ice flow, fire and flood. Some "deep ecologists" would even call humanity a cancer upon the Earth.[6]

Our ecologian, Father Thomas Berry, is undoubtedly right when he claims that

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[5] On the "greenhouse effect" in general, see Jonathan Weiner, *The Next One Hundred Years: Shaping the Fate of Our Living Earth* (New York: Bantam, 1990), esp. pp. 39–56. For the passion and death of nature in general, see Bill McKibben, *The End of Nature* (New York: Random House, 1989).

[6] See the remarks of Dave Foreman of the Wilderness Society and cofounder of Earth First! in the symposium "Only Man's Presence Can Save the Environment," *Harper's Magazine* (April 1990): 17–48. Also Michael Tobias, ed., *Deep Ecology* (San Diego: Avant Books, 1985).

> we have changed the very chemistry of the planet, we have altered the biosystem, we have changed the topography and even the geological structure of the planet, structures and functions that have taken hundreds of millions and even billions of years to bring into existence. Such an order of change in its nature and in its order of magnitude has never before entered either into Earth history or into human consciousness.[7]

Think of the poisoned waters of our own nation's aquifers, desertification in Africa's Sahel region, or that expanding hole in the ozone shield. For the first time, in other words, we have changed things to such an extent that the whole planet, as a habitat for life, stands in jeopardy.

2. A Question of Cosmology

So what is it that scientists and government bureaucrats cannot do? What is the missing element that Sagan & Co. beg us to supply? At one level, it has to do with political will—and the frustration that an "environmental President," for example, can be confident that the Catholic vote, the largest bloc in the nation, will be indifferent to almost the whole set of environmental issues, except maybe a garbage incinerator in the neighborhood. Global warming (the trend is not in doubt; the only question is how bad it will be) is somebody else's problem. There will be no political fallout, the President contentedly assumes, if the U.S. Government refuses to sign an international agreement to reduce carbon dioxide emissions. He can count on the fact that we do not respond to emergencies that unfold, like the greenhouse effect, in slow motion.

The political-will problem raises the question of our cosmology or lack of one. To put it starkly, my guess is that, like most Americans, our psychic energy centers around the effort to become an autonomous self, no longer at the mercy of fate or remorseless nature. And since this project, the theme of all our novels, in large part consists in detaching ourselves from nature, it tends to blind us to our connection, much less responsibility,

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[7] *Dream of the Earth*, xiii.

to the planet. This will no longer do. The deepest crises of society, argues Thomas Berry, come at those moments—like the fall of Rome, the rising money economy of the twelfth century, or the seventeenth-century scientific revolution—when the big story a culture has been telling itself is no longer adequate to meet the demands of the situation.[8] We stand at another one of those moments—when the story of the self that we have been telling ourselves has become a menace much like a narcotic drug. And getting off that drug will require more than moral exhortation. It will take something big and moving, the kind of vision that impelled our ancestors: a new covenant, a city built on a hill, the taming of a new wilderness, a new frontier. In short, some new American-dream theme, a leap of imagination that calls us forward to a fresh start and new worlds.

What we need—and implicitly what the Sagan letter asks of us—is a new cosmology, the kind of story that would fit into our liturgy. As I shall use the term "cosmology," it means the big story of the universe into which our lives fit.[9] It is the kind of whole-story by which, traditionally, people have always come to appreciate the meaning of life and from which they derive the psychic energy needed to face historical crisis. It is the way we get at the basic mysteries of existence, how we place ourselves and define our responsibilities in the world—as in the Genesis

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[8] Ibid., xi–xv.

[9] As the natural sciences understand the term, "cosmology" refers to a subbranch of physics or astronomy dealing with the origin and development of the astronomical universe as a whole (i.e., the formation of galaxies). See Dennis Overbye, *Lonely Hearts of the Cosmos: The Scientific Quest for the Secret of the Universe* (New York: Harper Collins, 1991). I am using the term in the broader, ancient-Greek sense of *kosmos*, an order of the whole that overlaps the boundaries of science, philosophy, and religion. As Stephen Toulmin points out, the Greek word for the physical universe was *ouranos;* so if one wants to be pedantic, physicists are only concerned with "ouranology." See Stephen Toulmin, "Cosmology as Science and as Religion" in Leroy S. Rouner, ed., *On Nature* (Notre Dame: Univ. of Notre Dame Press, 1984), 28. Also his *The Return of Cosmology: Postmodern Science and the Theology of Nature* (Berkeley: Univ. of California Press, 1982).

story of creation or its recapitulation in Christ at the Easter Vigil ceremony. In the language of our liturgy, the human fall is understood as the fall of nature as well—a bizarre notion that took our current ecological crisis to dramatize as the truth. What we need to understand more clearly is the corollary: that human destiny is wrapped up with the fate of nature, that the two are one thing, that humanity is not redeemed until nature is.

The task, I think, is to weave the poetry of Thoreau and John Muir into the biblical stories, and to complement such weaving with something like the mystique of the land heralded in the nineteenth century by the Hudson River and Luminist School painters. And then, to tie in the worlds of quantum mechanics, thermodynamics, and astrophysics, which are becoming curiouser and curiouser, and as such are a major source of the new American-dream theme. For it is my contention that the worldview filtering into our consciousness from various streams of modern science is wide open to religious meanings, indeed congruent with the language of liturgy. Our science and our laboratories, as Czeslaw Milosz avers, are making space and time "as sublime and magical as a fairy tale about elves."

3. Anthropocentrism and a Science of the Dead

Before I get to the cosmological agenda, however, there are a few obstacles to attend to, on both the scientific front and the religious. If you have been reading environmental tracts, as I have lately, one of the constant complaints you come across is the charge that the Judeo-Christian tradition is too "anthropocentric." This really has two parts to it. First, it reflects how the biblical perspective gets distorted when refracted through the lens of the story of the self that has dominated the West since the Renaissance. The point seems to be to save your own skin—and to "use" all other creatures to that private end. (Even the Principle and Foundation of the Exercises can be read in this way.) The classic example of such an interpretation, mightily popularized by the *Whole Earth Catalog* during the 1970s, is that of historian Lynn White, Jr., who charged in a 1967 article that

the Book of Genesis got Western culture off on the wrong track, using natural resources exclusively for our own selfish purposes.[10] On behalf of "the fish of the sea, the birds of heaven, all the wild beasts, even the lowly reptiles" that Genesis bids us to "master," White protested. And most environmentalists have followed suit in judging the Bible the enemy of ecological sensitivity and friend to a predatory extractive capitalism. Any viable religious vision for our day, they claim, must be "biocentric." The dubious biblical hermeneutics aside, I would agree: human goals, fed by a consumerist mentality and divorced from cosmic and planetary purposes, are invariably toxic. Our social concern must be stretched to include, not just fellow humans, but all Earth's creatures great and small. We must begin to understand that Earth and the human, as Fr. Berry has it, "are bound in a single destiny."[11]

The second element behind the "anthropocentric" charge has to do with something else, the perceived smallness of the biblical outlook. This is a neuralgic point, especially for scientists. Let me cite an example. "I was raised in a traditional religion that made much of 'indelible signs,'" recalls naturalist Chet Raymo;

> but early on I abandoned the theology and religious practices of my youth. I took academic degrees in science, and found in science a compelling vision of reality. . . . In science I discovered a universe of wonderful dimension, complexity, and beauty. It was a universe that folded inward to embrace the helical dance of the DNA, and outward to enclose the enigmatic quasars and spiraling galaxies. In the face of such a universe, the narrowly anthropocentric forms of traditional theology seemed inadequate. Nothing of what I had been taught in my religious education seemed quite capacious enough to encompass what I had learned in science.[12]

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[10] Lynn White, Jr., "The Historical Roots of the Ecological Crisis," *Science* 155 (1967): 1203–7.

[11] *Dream of the Earth*, 29.

[12] Chet Raymo, *Honey from Stone: A Naturalist's Search for God* (New York: Dodd, Mead, 1987), x.

"Narrowly anthropomorphic," not "capacious enough"—the expressions haunt me. Raymo is not alone. The problem is that for many soteriology is privatized into a "me and Jesus" affair where the main event is exclusively a post-earthly beatitude. Or, for the more sophisticated, the story of an itinerant Jewish preacher in the first century A.D. has lost its mythic dimension. Again, the distorting effect of our own individualism takes its toll. Having lost the sense that each one of us is capable of embodying a cosmic resonance, in parallel fashion we find that Jesus has shrunk down to our diminished size; he becomes just another atomized, historical individual. The story of the "historical Jesus" then sounds like one more Jewish lament, surely nothing that can stand up before Auschwitz. To rectify this situation, it seems to me, we need to recover a sense of the "true light" that was "in the beginning" and that "took flesh" in Jesus—in other words, recover a Johannine sense of the cosmic Christ. But the path to that end, I would say, may be indirect, a kind of detour. The first step may lie in another direction: to deal with our own self-diminishment, our own shrinkage. The initial task, I suggest, is to recover firsthand a sense that the whole cosmos resonates in each one of us. If I am right, that ought to open up the significance the Gospels attribute to Jesus. Expand your scope. Science helps you do it.

But not every kind of science will help. For instance, classical physics presents an obstacle. The problem is that Newtonian science, like all science since the invention of the wheel, diffused itself through myth and became myth. And as myth, it led us to C. P. Snow's "two culture" schism. That is, it provided no passage between the world of life and consciousness and the world of inert bodies moving according to the law of gravity. The mechanical "facts" that most of us learned in our chemistry and physics classes, it would seem, do not plug into the world of the humanities. No correspondence, no analogy. The movable feasts of culture, its poetry and narratives, operate by an entirely different energy supply than atoms do. So we were taught. (As for the animated "nature" of Bonaventure and Aquinas—so full of portent, symbol, and prefiguration—well, it was no match for the

obituary notice the immortal Newton had issued for it.) At best, these two worlds did not conflict (they were asking different questions, and we left it at that), but neither did they ever intersect or interweave. Despite the Catholic habit of ritually denouncing the Cartesian bifurcation of the universe into measurable, machine-like matter and immeasurable mind (*res extensa* vs. *res cogitans*), my suspicion is that we remained hopeless dualists.

Newtonianism was Descartes's dream come true. It was also the perfect ideology for the eighteenth-century urban manufacturers who were trying to displace a landed gentry that presided over a once dominant agricultural economy, in which fertile nature was perceived as a living force to be respected. By showing that nature was a machine, Newton issued permits to the manufacturers to exploit with impunity. And so in industrial economies it has gone since. Merciless exploitation of the environment, in fact, has our permission. Feeling shut out by a nature that is indifferent to human presence, all we could think of saying was "I am not that." With that dissociation, we effectively abandoned nature to self-aggrandizing geologists, miners, and lumberjacks who would do with it what they pleased—and pass the social costs on to the consumer-taxpayer. Again, the basic rationale for such license lies in classical physics, which is, as the French philosopher of science Michel Serres puts it,

> a science of dead things and a strategy of the kill. . . . The world is in order according to this mathematical physics. The laws are the same everywhere. . . . There is nothing to be learned, to be discovered, to be invented, in this repetitive world, which falls in the parallel lines of identity. Nothing new under the sun of identity. It is information-free, complete redundance. . . . There is death forever. Nature is put to death or is not allowed to be born. And the science of all this is nothing, can be summed up as nothing. Stable. Unchanging, redundant, it recopies the same writing in the same atom letters.[13]

[13] Michel Serres, *Hermes: Literature, Science, Philosophy*, ed. Josue V. Harari and David F. Bell (Baltimore: Johns Hopkins, 1982), 100.

In brief, a Newtonian cosmos was and remains a political instrument, ideal for eighteenth-century "benevolent" despots, as it has been for modern captains of industry. It allows for no genesis, no becoming, no novelty; hence, within its optic the evolution of the cosmos and of life on Earth is viewed as a complete anomaly. Humans are a mere blip on the screen, denizens of a negligible planet in the galaxy—in other words, perfect cannon fodder. Declare our independence, our consumer choices, as we will, we do not figure in the cosmic scheme of things.

If I'm not mistaken, we have some catch-up to do on this front. We suffer, I think, from a cultural lag, in particular, from scientific illiteracy. Many of us, I dare say, are not aware that Newton is no longer king. His death notice for the qualitative space and time in which Ignatius and the early Jesuits lived was premature. That had been a Ptolemaic world in which human moods were plucked, like the strings of a lute, by the "virtues" of Sun and Moon, by the copper of Venus, the iron of Mars, the lead of Saturn; in which the five wits—common sense, imagination, fantasy, memory, and conjecture—were felt to be "humored" by the wide seas and the heavenly waters descending from above the crystalline spheres. To be sure, the Ptolemaic cosmology within which the early Jesuits lived is gone. But something even more magical has replaced both it and the Newtonian cosmology. It is time, then, to look at some of that magic, and to begin weaving human destiny back into Earth's.

4. The Cosmic Clock: Toward a Johannine Recovery

What myth are we living by? What kind of cosmic story are we in? One considerable part of it, no doubt, involves the epic of evolution that Carl Sagan orchestrated in the celebrated "Cosmos" television series he narrated over a decade ago. You may remember the ingenious trick he used to dramatize the immensity of time and, proportionately, our insignificant instant on the scene. He called it the "cosmic clock." Imagine, he suggested, the entire fifteen-billion-year lifetime of the universe "compressed into the span of a single year." That would mean that the pri-

mordial Big Bang would occur on Jan. 1, and the whole of recorded human history would fit into the last ten seconds of New Year's Eve, Dec. 31.

The picture goes something like this:[14]

Jan. 1: Big Bang.

May 1: Origin of the Milky Way galaxy.

Sept. 9: Origin of the Solar System.

Sept. 14: Formation of the Earth.

Sept. 25: Origin of life on Earth.

Oct. 2: Formation of the oldest rocks known on Earth.

Oct. 9: Date of oldest fossils (bacteria and blue-green algae).

Nov. 1: Invention of sex (by microorganisms).

Nov. 12: Oldest fossil photosynthetic plants.

Nov. 15: Eukaryotes (nucleated cells) flourish.

Dec. 1: Significant oxygen atmosphere develops on Earth.

Dec. 5: Extensive vulcanism and channel formation on Mars.

Dec. 16: First worms.

Dec. 17: Paleozoic/Cambrian era: invertebrates.

Dec. 18: First oceanic plankton, trilobites.

Dec. 19: Ordovician period: first fish, vertebrates.

Dec. 20: Silurian period: first vascular plant; plants begin colonizing the land.

Dec. 21: Devonian period: first insects; animals begin colonizing the land.

Dec. 22: First amphibians and winged insects.

Dec. 23: Carboniferous period: first trees, first reptiles.

Dec. 24: Permian period: first dinosaurs.

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[14] See Carl Sagan, *The Dragons of Eden: Speculations on the Evolution of Human Intelligence* (New York: Random House, 1977), 14–16.

Dec. 25: Paleozoic/Mesozoic periods.

Dec. 26: Triassic period: first mammals.

Dec. 27: Jurasic period: first birds.

Dec. 28: Cretaceous period: first flowers; dinosaurs become extinct.

Dec. 29: Cenozoic era and Tertiary period begin. First cretaceans and primates.

Dec. 30: Early evolution of frontal lobes in primates. First hominids; giant mammals flourish.

Dec. 31: End of Pliocene period. Pleistocene and Holocene periods: first humans.

An astrophysical angel, you might say, would scarcely have time to notice us, much less figure out what such mites were doing in the cosmos! By this scale the birth of Christ would have occurred only seconds ago—at precisely 11:59:56 P.M.—and the Renaissance two seconds later. Do we yet realize what such events, barely past us, mean?

People will someday wonder, Owen Barfield once wrote in 1957, how we could have been so blind: that

> a religion which differed from all others in its acceptance of time, and of a particular point in time, as a cardinal element in its faith; that it had, on the other hand, a picture in its mind of the history of the Earth and man as an evolutionary process; and that it neither saw nor supposed any connection whatever between the two.[15]

One would also have expected, he goes on, that those who considered Jesus of Nazareth the culminating point of the history of the Earth, indeed as its savior, would "feel that we are still very near to that turning-point, indeed hardly past it; that we hardly know as yet what the Incarnation means. . . ."[16] For against the 4.6-billion-year history of Earth, what is a mere two thousand

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[15] Owen Barfield, *Saving the Appearances: A Study in Idolatry*, 2nd ed. (Middletown, Conn.: Wesleyan University, 1988), 167.

[16] Ibid., 168.

years? Do we comprehend any event that we are "hardly past," that in astrophysical time happened only seconds ago? And how can we begin to apprehend such an epiphany if we do not have our ears to the ground to hear the primordial Sound, the subtle vibration that John's Gospel calls "the Word," that was in the beginning, that resonates through all things?

Today, thanks to the implications of Einstein's equations of general relativity (1915), we have a striking metaphor (or, if you prefer, an analogy) for that primordial Sound of John's Gospel. Back in 1963, when Arno Penzias and Robert Wilson, two Bell Laboratory researchers in Holmdel, New Jersey, discovered the very low 3° kelvin background radiation from the Big Bang, they thought it must be a mistake, something wrong with the large microwave antenna they had set up to communicate with a Telstar satellite. It took them a year to realize that no, the persistent hiss they had been picking up was the sound of something that Edwin Hubble had theorized about back in 1929: that space itself, not just objects in space, is everywhere expanding from a common origin about fifteen billion years ago. They had detected the echo of the birth of our universe.[17]

We can't exactly imagine it as a TNT blast, starting from a definite center and expanding to engulf everything around it. No, as more than one physicist has suggested, it was more like the first fortissimo bars of a great symphony, which occur simultaneously everywhere, filling all space from the beginning, with every particle rushing apart from every other particle. However, at one hundred billion degrees centigrade, it was initially too hot for any stable particles to form. Only gradually, as things cooled,

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[17] For an account of the Big Bang, see Ian G. Barbour, *Religion in an Age of Science* (San Francisco: Harper & Row, 1990), 125–28; also Louise B. Young, *The Unfinished Universe* (New York: Simon and Schuster, 1986), 37–56; Lyall Watson, *Lifetide: The Biology of the Unconscious* (New York: Simon and Schuster, 1979), 23–42; Stephen W. Hawking, *A Brief History of Time: From the Big Bang to Black Holes* (New York: Bantam, 1988), 35–51.

did the elements, the galaxies and the debris we know as solar systems, shake themselves out of the initial plasma.

The Big Bang does not "prove" the existence of a Creator, much less a beginning in time or creation ex nihilo. Science is asking a different kind of question from the religious one, and therefore belongs to a distinct logical category. No direct inferences can be made.[18] Penzias and Wilson heard the sound of our universe being born; but, if physicist Hugh Everett is right, there may be an almost infinite number of worlds existing simultaneously with ours. Astrophysicists also speculate, like medieval cabalists, that there may have been many before our version. For, if Stephen Hawking is correct, it may be a matter of successive cycles: the universe could be oscillating in serial fashion, collapsing periodically into a black hole of incredible density (a Big Crunch) and then exploding again from a "singularity" where the ordinary laws of physics don't hold up. This may have been happening forever—beginninglessly. The Book of Genesis doesn't care; it is concerned only about the goodness of creation and the issue of ontological dependence at every moment, however it happens. Still, if we are brushed by Big Bang radiation, a kind of cosmic breeze, this is undeniably an apt image of another kind of energy effulgence: Aleph, the Great Beginner moving over the void—pouring out, emptying, informing, quickening, breathing into the chaos. Another frequency, another Sound.

5. The Anthropic Principle

Things get curiouser and curiouser. It's almost as if the universe had designs on us. The dice were loaded in our favor from the outset. Physicists call it the "anthropic principle," which might better be named the biotic principle.[19] The idea is that

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[18] See Barbour, 128–35. For a different view, see Gerald L. Schroeder, *Genesis and the Big Bang: The Discovery of Harmony Between Modern Science and the Bible* (New York: Bantam, 1990).

[19] See John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (New York: Oxford Univ., 1986); also Barbour, 135f.

against all the odds the universe is fine-tuned for life. This has to do with three sets of phenomena: (1) the rate at which the universe is expanding, (2) the formation of elements, and (3) the particle/antiparticle ratio.

First, the **expansion rate.** As Stephen Hawking puts it, "if the rate of expansion one second after the Big Bang had been smaller by even one part in a hundred thousand million million it would have recollapsed before it reached its present size."[20] On the other hand, if the expansion rate had been greater by a part in a million, the universe would have ballooned out too rapidly for stars and planets to form; and, since the heavier elements required for life are formed in the stars, there would have been no life. As things stand, however, the initial explosive energy, the mass of the universe, and the strength of gravitational forces were exactly balanced so that life could emerge.

Next, the **formation of elements.** Four force fields hold everything in the expanding universe together and govern its energetic processes: (1) the strong force that holds atomic nuclei together, (2) the weak force responsible for radioactive decay, (3) electromagnetism responsible for light and electrically charged particles, and (4) gravity. If the weak force had been even a mite stronger, all hydrogen would have dissolved into helium; this would have entailed the absence of water and stable stars that provide energy for life. As for the strong nuclear force, if it had deviated from its actual strength by as much as one percent, no carbon, the basic building block for DNA, would have formed inside stars. In turn, had electromagnetism been even slightly stronger, stars would have been too cold to explode as supernovas, and thus would not have sprayed the planets with the heavier elements necessary for life. Similarly, the ratio between gravity and electromagnetism is critical for stellar and galactic evolution.

Finally, the **particle/antiparticle ratio:** Not only are the binding forces precisely adjusted for the development of life, but

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[20] *A Brief History of Time,* 121f.

so too are particle masses and the charges of neutrons, protons, and electrons. If in the early universe every proton had been matched by an antiproton, they would have annihilated each other, and our kind of material world would never have happened. Instead, things were slightly asymmetrical: for every billion antiparticles, there were a billion and one particles—just enough of an edge.

What to make of this? The point, as Hawking phrases it, is that "the odds against a universe like ours emerging out of something like the Big Bang are enormous. I think there are religious implications."[21] From this angle, it begins to look as if human beings, for all their distinctiveness, are modes of being of the universe. As Thomas Berry has it, a human is "that being in whom the universe comes to itself in a special mode of conscious reflection."[22] What are you looking into when you gaze into the face of another human being? There is every indication that you are seeing a hologram, a fragment that embodies and personifies the whole cosmos—and into whose hands at least this planet has cast its fate.

6. A Brief History of Physics (Newton to Hawking)

Ah, but we have been getting ahead of ourselves in our weaving. Perhaps it would be well to backtrack and see where we've been coming from—in particular, to understand where and how the closed, deterministic world of Isaac Newton suddenly began to open up to unexpected meanings and cross-references. The shift is important. For, as long as a Newtonian worldview holds our imaginations in thrall, we are forced to keep two separate accounts, one for the physicist's dynamics of energy and another for all the subtle signs and symbols of the life-world. Subject and object, eros and matter, poetry and the law of gravity do not jibe; and so we remain dualists. But the Newtonian

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[21] Quoted in John Boslough, *Stephen Hawking's Universe* (New York: Morrow, 1985), 121.

[22] *Dream of the Earth*, 16.

worldview is a very high abstraction, a matter of extremely selective attention. Over the last century and a half, what some would claim is a new scientific paradigm has slowly been taking shape, one of those "scientific revolutions" Thomas Kuhn speaks of.[23] However one chooses to characterize the shift, this gradually emerging image of the cosmos has room, in ways that a Newtonian universe did not, for chance, time, complexity, and radical analogies between a human world of signs and the multileveled world of nature. Starting with classical mechanics, what follows is a short review of the different image of nature emerging from thermodynamics, microscopic quantum physics, information physics, and the physics of chaos. Stick with me; if I can get it, anyone can. Especially if you are hunting for signals of transcendence or "rumors of angels."

Classical physics

Newton imposed martial law on nature. He placed everything in an absolute container space and lined up atoms in strict military file. As John Donne phrased it, "The Element of fire is quite put out . . . and freely men confess that this world's spent." Nature's eros and ambiguity, so familiar to the ancients, is simply repressed. Nothing shows this better than the puzzle of Newtonian dynamical motion.[24] Newton formulated immutable laws for what physicists call "integral systems," stable, closed systems whose every instant, like that of an automaton or a pendulum, is the integral repetition of the preceding instant. The procedure was to posit a body (inert matter) in isolation, endowed with rectilinear and uniform motion (the so-called initial conditions); one then calculated the modifications of this linear

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[23] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962). Also Ken Wilber, ed., *The Holographic Paradigm and Other Paradoxes: Exploring the Leading Edge of Science* (Boulder, Col.: Shambhala, 1982).

[24] For a comprehensible account of classical dynamics, see Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos: Man's New Dialogue with Nature* (New York: Bantam, 1984), 27–77.

movement from place to place (the trajectory) as determined by external forces (wind, waterpower, horsepower, gravity, muscle, and so forth). The point was to deduce the truth concerning all other possible states of the system—the distribution of masses in space and their velocities, for instance—from the initial conditions. The time variable is irrelevant; in principle, the motion is perfectly symmetrical and therefore reversible. So far as Newtonian law is concerned, the film of the motion can run backward; one's tomorrows are identical with one's yesterdays. As Alexander Kóyre once remarked, this is "a notion as paradoxical as that of change without change." Newtonian nature thus represents perfect redundancy. Nature is stuck as if it were pure monotone, vibrating at only one frequency. Which means that nothing can come of it. The timelessness of classical physics thus runs counter not only to the time-centeredness of Western culture but to the evolutionary outlook that Darwin would introduce.

Now with due allowances for the curvature of space, Newtonian mechanics remains highly useful if you want to shoot a satellite at the Moon. But first of all, Einstein's theory of relativity did away with the idea of an empty container space. All those supposedly unchanging, "objective" properties of length and mass, independent of any observer, turn out to depend on the observer's frame of reference. And space itself turns out to be constituted, not by fixed substances, but by dynamical events or processes. Secondly, Newton's schema has little to tell us about how any natural system, from galaxies down to DNA molecules and electrons, actually functions internally, for the simple reason that, outside of a human artifact, everything in nature is madly exchanging energy with its environment. The supposition of isolation is a fantasy; from stars to protozoa, nature operates with **open systems** that are inherently nonlinear and unstable. The rule is: The more complex the system, the more unstable it is—that is, the more it is a precarious balancing act between disorder and order. In short, supernovas and subatomic quarks more closely resemble a human being than anything Newton imagined. Such affinity is fundamental to post-Einsteinian physics. In

effect, one might say that nature, too, writes straight with crooked lines.

Thermodynamics

The breakdown in the Newtonian worldview happened a good deal before Einstein. It began to happen, coincidentally enough, about the same time that all those steam engines that James Watt had invented in the late eighteenth century started to pollute the atmosphere with carbon dioxide. That is, it began with the early nineteenth-century industrial revolution and the physics of fire that went with it. Where Newton had imprisoned matter in hard-edged geometrical diagrams, Watts's engines melted all those straight edges, sharp lines, and stable forms and made matter vibrate, oscillate, and dissolve into aleatory clouds. (If you are familiar with the fiery tugboats and locomotives portrayed in J. M. W. Turner's paintings—figures in a sea of exploding energy—you will have a graphic representation of how physicists were at the time altering our image of nature.) To say the least, matter could no longer be seen as inert. Physicists did not recognize it at first; but they were about to break free of a rigidly deterministic universe and enter a stochastic or chancy one, where things could only be calculated, as they are with human beings, in terms of probabilities. And here, for the first time in classical physics, contingency and irreversible time began to count—again, as they do for us.

The physics of the industrial revolution was thermodynamics, a theory of heat transformations.[25] The effort was not just to understand that the amount of energy, whatever form it was converted into, remained constant (the law of conservation), but to get a handle on the inevitable dissipation of usable energy (the law of entropy, from the Greek word meaning turning or change). For thermodynamic systems, unlike Newton's billiard-ball objects, varied from their initial conditions. They wore

[25] For background to my account of thermodynamics, again see Prigogine and Stengers, 103–29. Also Serres, 54–62.

down, rusted, decayed: their tomorrows are different from their yesterdays. Irreversibly over time, the kinetic energy available for work in any form—electrical, chemical, or heat—had to be paid for in waste and structural degeneration. The odds, thermodynamicists realized, are stacked in favor of disorganization or that return to utterly random buzzing that physicists call thermal "equilibrium." That is, the arrow of time inscribed in the law of entropy and the time arrow of Darwin and biology ran in the opposite direction; the former ran downhill to chaos. In the late nineteenth century, humanists like Henry Adams were not cheered by this news; they took it as a pronouncement of doom: that the cosmos and the planet were fated to a chill state of absolute enervation. In effect, there would eventually be no tomorrow. The question of how Darwin's world fit into this bleak picture, that is, how things ran uphill, against the entropic tide, remained a puzzle, a strange anomaly that until recently physicists tended to discount as unimportant in the macroscopic scale of things.

Quantum physics

"Those who are not shocked when they first come across quantum physics," remarked Niels Bohr at the dawn of the nuclear age, "cannot possibly have understood it."[26] As their instrumentation improved, physicists began the descent into this weird, microscopic realm. Looking back to the nineteenth century, one can say that the furnaces of Watts and of Bessemer's steel mills had opened the door to the discovery of atomic and nuclear dissemination. In the latter part of that century, entropy had been translated into randomized molecular activity. In our century it would appear as the indeterminate behavior of the subatomic quantum world. Newtonian mechanics and the order-

[26] For a concise summary of quantum weirdness, see Barbour, 96–102; for complete accounts, see Heinz Pagels, *The Cosmic Code: Quantum Physics as the Language of Nature* (New York: Simon and Schuster, 1982) or Nick Herbert, *Quantum Reality: Beyond the New Physics* (New York: Doubleday/Anchor, 1985).

liness of the periodic table of chemical elements, it became clear, were exercises in statistics, a lawfulness at the macroscopic level that rode on a wildly chancy underworld.

There, highly charged particles are awash in Brownian motion. That is, they dance like aimless sunbeams, mere potencies waiting to connect, interact, and combine. "Mere" potencies, did I say? Rather, unbelievably huge potencies: to calculate their energy when in a particulate state, as Einstein informed us, one has to multiply mass by an enormous constant, the velocity of light squared ($E=mc^2$). Nor can you pin down their dance (Werner Heisenberg's law of indeterminacy). If you manage to locate position in a cloud chamber, the velocity escapes you; and vice versa, if you track velocity, position evaporates. Worse, paired particles of opposite charge seem to be psychic, communicating at faster than the speed of light no matter how far apart (Bell's theorem).[27] If you want a visual picture of all this, think of the wonderful chaos of a Jackson Pollock painting, and then imagine that Einstein, Werner Heisenberg, and Erwin Schrödinger more or less made sense of it.

Einstein had recognized in 1905 that, contrary to received opinion, light acts like a particle. By the 1920s Louis de Broglie saw that particles act like waves. Yes, energy comes in only certain packets, like denominations of money (Max Planck's quanta); but then it confoundingly behaves like a field spread out all over. In quantum theory, the total pattern of these dynamical, interpenetrating events does not derive from, nor can it be reduced to, constituent, cloud-like electrons or other subatomic particles; hence the laws in this area are holistic, the result of a particle wave's participation in a more inclusive pattern (the Pauli exclusion principle).[28]

But think for a minute what this field phenomenon means: Newton's conception of matter as a self-contained entity that is

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[27] For Bell's theorem, see Barbour, 106–8; Herbert, 199–231; Pagels, 160–76.

[28] Cf. Barbour, 104f.

merely externally related to other things is finished. That we still use the adjective "atomistic" as a synonym for separation is a sign of our cultural lag, our scientific illiteracy. The atoms of which you and I and everything else are composed are decidedly not isolates. They entangle themselves with the fields of all their compatriots; and as such they are internally constituted by their relationships. The mutual impact may be slight, but the brilliant Crab nebula in our starry sky doesn't make a move without affecting me, nor do I make a move without somehow influencing it. The truth is that on the physical level the one is in the many, the many in the one; matter/energy is profoundly social. But the surprises do not stop there.

Information physics

For Einstein, space is inseparable from time; everything is a signal system that takes time to constitute itself spatially. ("There is no nature," as Whitehead summed it up, "at an instant.") That insight was to reshape our century: What energy was to the nineteenth century, information (or signaling in some form) is to the twentieth. At the beginning of this century, information physics (also known as cybernetics) began to find a fresh use for the fact that the dice are loaded in favor of entropic flux. New concepts were introduced—information, redundancy, and noise—and their connection to thermodynamics was quickly demonstrated. It was shown, for instance, that information, which is equivalent to organization, was a form of counter-entropy or negentropy. This made it possible to translate a "bit" of information into mathematical terms. What one had to do (if you were a statistician) was to see the improbability of organized energy against the backdrop trend toward entropic incoherence or sheer noise. Accordingly, anything from the message of quasar radiation to that of a DNA molecule could be measured as

the inverse of its entropy, or the negative logarithm of its probability.[29]

Another, more accessible way to speak of this is to say that everything in the universe, from the Crab nebula to an atom of hydrogen, is a time series, a sequence of signals; and this makes it a process, not a static thing. To constitute itself, a process must vary its signals according to some kind of statistical regularity—in effect, use a standard code, a protoalphabet, a set of grammatical rules that generate, within limits, a wide variety of programs or messages. (The code of the DNA molecule discovered by Crick and Watson in 1955 is a perfect example: an "alphabet" consisting of four nucleotides, forming three-letter "words" for twenty amino acids, which are arranged into "sentences" that can specify one of thousands of proteins necessary for organic life.) Too much random noise on one side (mere buzz), and you get free, unbound energy that does no work. Or too much redundancy on the other (monotone), and you get such frozen rigidity that there is no information, merely cliché or platitude. Signal systems exist between these two extremes; they are balancing acts.

The implication: We no longer need to carry the physicist's energy and the humanist's signs and symbols (information, that is) in separate accounts; one balance sheet will do. We are back to a semiotic universe, a world that gives signs. Divisions of natural science and divisions of humanities no longer need to figure themselves as concerned with disparate things. One sector merely deals with primitive sign systems and their protolanguages and protogrammars, whereas the other deals with more highly developed sign systems and their meanings. This unification authorizes us to return to the idea, so keenly felt by the ancient Greeks, that the dramas of Aeschylus and Euripides confront the forces of nature in us: the hurricane, the raging ocean, the wail of the wind, indeed, the thermonuclear turbulence of the stars.

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[29] For a lucid account of information physics, see Jeremy Campbell, *Grammatical Man: Information, Entropy, Language, and Life* (New York: Simon and Schuster, 1982).

When the physicist and climatologist study the vagaries of a tropical storm, it is true they have different ends in view than Shakespeare did when he brought the storm on the heath into the soul of King Lear. In a different form, however, alchemized by the human spirit, it is the same natural force. Does this sound farfetched? Just wait.

Chaos theory

Information theory also brings us back to a universe that exhibits family resemblance and analogy through and through, from top to bottom. Or, as the ancients would have put it, microcosm reflects macrocosm and vice versa. The big illumination in this regard has come only in recent years, as physicists joined forces with molecular chemists and climatologists to turn their attention to the middle-range-sized systems of some complexity like clouds, the shapes of lightning, the microscopic intertwining of blood vessels or the galactic clustering of stars. Where Newton had banished all ambiguity, the new science had to start paying attention to the erratic side of things, the breaks in symmetry and the patterns embodied in wholes.[30] Among other things, this forced scientists to reform their habit of always reducing things to their analytic parts as the sole mode of explanation. Yes, a microevent in a nervous system can be amplified throughout a whole neural network; and one mutation in a simple component of a genetic sequence can change evolutionary history. But it is equally true that changes in larger wholes—a solar system, an atmosphere, an ecosystem, a brain—can work their programs on molecular and atomic substructures. Causal efficacy works both upward (from atom, molecule, and cell), and downward from the macrolevel.

Let me cite but one example of a subtle new order springing from flux, the behavior of those signaling "balancing acts" I just referred to above. Before we anthropoids ever arrived on the

[30] For an intelligible account of this new direction in science, see James Gleick, *Chaos: Making a New Science* (New York: Viking, 1987).

scene, impersonal nature was expert, it would appear, at decoding messages out of seeming chaos. In 1977 the Belgian physical chemist Ilya Prigogine won the Nobel Prize for an elegant mathematical formula for the nonequilibrium thermodynamics of open systems (he called them "dissipative structures," because they are high producers of entropy).[31] As I have already noted, open systems that exchange energy with their environment include nearly everything of interest to us in nature, from galaxies to organic compounds and embryos. In general, nonequilibrium thermodynamics focuses on the paradox that such systems maintain themselves against the eroding tide of entropy precisely by metabolizing that chaos, in the way that plants ingest or photosynthesize the photons of the Sun. To the Sun, the photons are waste, sheer noise; to the plant, they are an energy source to be converted into information/food. In turn, that begins another cycle: the plant breaks down carbon dioxide and gives off excess oxygen, which is waste as far as the plant is concerned but has been converted into the very lifeblood of animals. It is not by maintaining ourselves at perfect equilibrium—by droning a single note, as Newton supposed—that we, plants, and the stars organize ourselves and move uphill against death, but precisely by maintaining this precarious balancing act between order and instability. The star, the plant, and my body literally eat buzzing, blooming confusion and transform its random nonsense into the information that in the one case directs thermonuclear operations, in the other controls photosynthesis, and in my case turns up as DNA code and enzyme production. It is a story, through and through, of metamorphosis, transformation—or, if you like, of transubstantiation.

In the course of these transformations, the star, the plant, and I keep changing the direction of the time arrow, in effect changing its sign from negative (degrading, aging, negentropic)

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[31] See Prigogine and Stengers, 177–290. For the social and ethical implications of this theory in general, see Erich Jantsch, *The Self-Organizing Universe: Scientific and Human Implications of the Emerging Paradigm of Evolution* (Oxford: Pergamon Press, 1980).

to positive (upgrading, enhanced, negentropic organization). The whole complex hierarchy of nature works this way: What is waste or noise thrown off at one, simpler level is absorbed at another, more complex level and transmuted into information/structure. The more complex the system is, the more it recycles energy, which it never gives back in the same form in which it took it in.[32] Interstellar gas left over from the Big Bang in the course of time gestated carbon and various organic compounds vital to life that meteorites rained down upon planets like Earth, giving rise to blue-green algae which fed upon the photons of minor stars like the Sun. In return, the algae very likely produced a breathable atmosphere for more complex aerobic life. In turn (if biochemist James Lovelock is right with his Gaia hypothesis), the green world as a whole may very well regulate Earth's climate and the chemical composition of the atmosphere, keeping it steady against the heat of the Sun, which has increased from thirty to fifty percent since life began.[33] Eventually, after a great deal of recycling and chance variation of genetic nuclei, that atmosphere made it possible for us hominids to survive until, in return, we acquired speech and began to transform the energy of interstellar gas, Sun, and the green world into a good story. The universe, in short, is organized like a grand meal.

Now Prigogine's contribution to this picture consists in his recognition that the introduction of noise or random variation into open systems has everything to do with their capacity to evolve—or as Teilhard de Chardin would have put it, to complexify.[34] In certain unpredictable instances, order springs from chaos: in a sort of replica of civil disobedience, open systems break law, break symmetry. Turbulence in one small sector of the system seemingly bolts from the previous order and produces a new level of organization. Thus the law of large numbers, the effort of the prior redundant order to repress innovation, does not always

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[32] See Serres, 3–14, 71–83.

[33] James Lovelock, *The Ages of Gaia* (New York: W. W. Norton, 1988).

[34] See Prigogine and Stengers, 257–313.

obtain. In effect, a minority disruption gets the upper hand and reorganizes the whole. And it gets the force to do so from the reservoir of free-floating energy that the universe, thanks to the Big Bang, so amply provides. The image goes something like this: Just as water moves through a whirlpool and simultaneously creates it, so the cosmic river of random energy that physicists call entropy moves through and creates a disturbance in the flow. That's the open system, and the more complex it is, the more chaos it can take into itself and convert into higher types of order. In other words, put slow-moving nature into a time-lapse film, and it not only blooms, but begins to look like Chicago or New York City. It's as if the universe were built on the premise of James Joyce's *Ulysses*.

What does a living system, an organism, look like in such a context? Michel Serres describes it as a "barrier of braided links that leaks like a wicker basket but can still function as a dam."[35] An organism is neither static nor homeostatic. It is a quasi-stable turbulence, a flow-through whirl. It ferries, as a river does, both energy and information, both order and disorder. And it cannot be defined except from a global perspective; for the circulation of energy from the Sun to the black depths of space is integral to its precarious balancing act. Without the great river of flux, there is no eddy, no knot pushing upstream in the flow. Indeed, this temporary knot, this island or string of islands arranged in an archipelago, is woven out of all times: the great thermal drift itself, redundant vibrations of chemical elements, the relative stability of genetic nuclei, erratic mutations, feedback loops, and the filtering out of nonviable elements by a process of reproductive selection. All times converge here. An organism, says Serres, is a "sheaf of times . . . a bouquet of times."[36]

And what are we humans, the observers, in this perspective? We come at the end of the cosmic meal, at the end of an enormously complex chain of conversions of noisy energy radiat-

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[35] *Hermes*, 75.

[36] Ibid.

ing to us in torrents and stretching back to the formation of galaxies out of the energy released by the Big Bang. Quite literally, we are the fallout of the stars, for without star factories converting helium out of hydrogen, there would be no oxygen, carbon, or iron; and without them there would be no amino acids or proteins for life; and without the radiation spilled over by the initial hydrogen-helium conversion, billions of stars would go dark. There would be no Sun, no day to nourish life.[37]

Like the stars, we, too, are dynamic energy systems, internally constituted by our relationships. We are open thermodynamic systems moving upstream and drifting toward death; and thus, like the Sun and the Moon, we are disturbances in the field, vortices in turbulent nature. Like them, we are constantly recycled, dissolving and reappearing. We regrow our entire physical body as we do hair and nails. Nothing in our genes was present a year ago. The tissue of our stomach renews itself weekly, the skin is shed monthly, and the liver regenerated every six weeks. Every moment, a portion of the body's 10^{28} atoms is returning to the world outside, and ninety-eight percent of them are replaced annually. Each time we breathe, we take in a quadrillion atoms breathed by the rest of humanity within the last two weeks and more than a million atoms breathed personally by each person on Earth. So much for the strictly bounded, separate individual.[38]

As observers, then, we are not structurally different from the crystal, the plant, the animal, the order of the world that we observe. We understand them because of our affinity: like them, both determined and riddled by chance, we are noise, disorder, and chaos on one side; complexity, arrangement and order on the other. Like the rest of the cosmos, we give signs. In a vast chain of conversions of chancy energy, we are simply the final alchemists, the last transformers and interpreters, the ultimate

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[37] See Young, 121–23.

[38] See Larry Dossey, *Space, Time & Medicine* (Boulder, Col.: Shambhala, 1982), 72–81.

black box. As Serres says, "We are submerged to our neck, to our eyes, to our hair, in a furiously raging ocean. We are the voice of this hurricane, this thermal howl, and we do not even know it."[39]

Our Response

7. Seventh-Inning Stretch

At this point, you may need to stop, stretch, and breathe deeply. And ask yourself (and me) where we find ourselves now. We started out worrying about the desecration of Earth, and then turned to our individualism as a major source of the problem. In turn, that led us to our Cartesian dualism and its confirmation by the Newtonian myth of an easily exploitable world—an idea that continues to fuel the myth of Progress and an ethos of unlimited economic growth. GNP is god, our idol. Such reflections sent us searching for a new cosmology, one that would highlight our kinship with Earth's biological community and that single destiny we have with Earth. I was looking for a symphonic account, if you will, that would play inside our churches and would dazzle us by its beauty. Only the reader may judge, but I think we sounded some of the first chords of that music, as in J. R. R. Tolkein's description of Iluvatar's creation recounted in the opening pages of *The Silmarillon.*[40] The vast cosmos hymns inside us—we are "bouquets of time," "the voice of the hurricane."

Maybe, after all, the major task of human existence is not, as the dissociated individualist assumes, that each expresses his or her little personality. Perhaps the idea is to create **and conserve** as the Creator does, something that would be a good deal more taxing. At the heart of physical reality, in any case, we find communion. Quantum events, we said, are field phenomena;

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[39] *Hermes*, 75.

[40] J. R. R. Tolkein, *The Silmarillon*, ed. Christopher Tolkein (Houghton Mifflin, 1977), 15f.

and taking his cue from this fact, musing on it, in 1929 Alfred North Whitehead constructed a whole metaphysical cosmology. What quantum weirdness intimated to him, however, was not that life can be modeled on the inanimate, but just the reverse, that quantum reality exhibits traits of a human being! And so he supposed that all actual entities in this universe are self-organizing—or, as the expression goes these days, *autopoetic.*[41] Moreover, he held that such self-organization consists of becoming itself by internalizing to some degree the whole cosmos. That is to say, every actual element "prehends"—and thus is internally related to—everything else, however dimly. The "everything else" includes that ultimate "surd" he called God, "the fellow sufferer who understands."[42]

But being practical, autopoetic readers, you will want some intimation of what to do with all this information. My first suggestion is: Don't do anything, just stand there! Muse and soak in the wonders of creation in detail. My strategy in the preceding pages, of course, has been just that: to dazzle you with the wonder of "how God works and labors . . . through the elements, the plants. . . ." I leave it to you to work on biology and the natural history of animal behavior. It is no mystery, I think, that the Society's spirituality intensified a G. M. Hopkins's keen eye for flora and fauna, or that it has produced so many splendid scientists. What else could happen if one took the *Ad amorem* seriously? They fell in love with the universe, with Brother Sun and Sister Moon, Wind and Water, Fire and Mother Earth. I would have each of us do the same, whether we are professional scientists or not. The very planet, overloaded and stressed to its limits, above all demands our honor, our love. Protecting whales and snail darters or conserving soil, fossil fuel, forests, water, and ozone layer—the deeds by which love shows itself—come second and fall into place, I think, if we keep first things first: the majesty of our setting.

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[41] See Jantsch, 29–41.

[42] Alfred North Whitehead, *Process and Reality: An Essay in Cosmology* (New York: Harper Torchbook, 1957), 532; see also pp. 238–54.

What I have offered, therefore, are grounds for romance (that is, grounds for what G. K. Chesterton believed "orthodoxy" to be about). It is merely a sketch, something that may whet your appetite for the books of all those naturalists and scientific popularizers that fill the bookstores these days: Joy Adamson, Dian Fossey, Farley Mowat, Barry Lopez, Annie Dillard, Lyall Watson, Gary Snyder, Lewis Thomas, Stephen Jay Gould, Rene Dubos, Chet Raymo, James Gleick, Louise B. Young, William H. Calvin, Wendell Berry, and so many more. To my way of thinking, they all present meditation fodder—ways of showing you in detail how "nature is never spent; / There lives the dearest freshness deep down things." It is soul food for the preacher, retreat director, and teacher. What Jesuits and other religious communities can do best in behalf of the planet in a time of trial, I am convinced, is to provide background music for all the tough ethical questions that we and our clientele must face up to in an ecological age. If that requires a little rhapsodizing about nature, then so be it. Love—that Love that "moves the stars and the planets," as Dante has it—shows itself in deeds; and nonequilibrium thermodynamics is one of those deeds.

That one may justifiably rhapsodize about nature is not to say that nature is to be romanticized, much less sentimentalized. For if the account in Section 6 is at all accurate, all the dissonance and chaos that erupt out of our own unconscious, all the raging oceans of libido, are simply the reverberation within us of great, unfinished nature itself. Fifteen billion years of evolution, a proliferation of forms out of chaos, are inscribed in our bone marrow, in our nervous tissue. Thus nature's abysmal black holes, doldrums, glacial states, titanic powers, lofty peaks, mighty floods, and fossil fuels are in us. The human soul is only potentially all things, whereas our bodies are actually so. Little wonder, then, that psychoanalysis tends to be interminable. For what are we trying to do in such sessions but break out of some neurotic redundancy by letting the chaos in us speak? That is, what is the effort about except to return a good story for what we have received or suffered? As if Mother Nature, muttering in her sleep in our bellies, were urging us to dig the poetry out of

her, pour soul into her, make something beautiful of her. As if we owed her that.

Musing like this leads, of course, to the tough ethical issues, which I do not wish to scant. Love Canal, Three Mile Island, Chernobyl, Bhopal, the Valdez oil spill—the ecosystem is in grave trouble, and we sleepwalkers with it. Not knowing what we do with a consumerist mentality, America corporately fills the air with carbon, freon, methane, and nitrous oxide, all of which attack the planet's immune system. We are sentencing nature to death, to her own passion and crucifixion. Toxic cleanup, pollution control, energy conservation—all are urgent.[43] The Worldwatch Institute estimates that Americans could cut their energy consumption by fifty percent and save $200 billion a year without serious sacrifice. But will it happen? Not likely.

Why the fierce resistance? The reason is a cultural habit of the mind and heart: restraint throws sand in the wheels of Progress, the myth of growth by which our culture currently lives. Small is not beautiful. The Biopower Company would have to cease cutting down the rain forest in the big island of Hawaii for wood chips; the Japanese could not get fire-sale prices for Brazilian and northwest American lumber. Detroit would have to improve mileage rates on its gas-guzzlers. The bottom-line accountants and financiers all see huge costs for retrofitting and redesigning, and the ordinary worker sees layoffs. Who wants to argue about the obligations of "sustainable growth"? Or hear that the new American-dream theme *and* the new "Japanese miracle" require ascetic renunciation in an age of limits? And so, like the Nile perch imported to Lake Victoria, we proceed to eat up our

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[43] For a solid, informative overview, see Herman E. Daly and John B. Cobb, Jr., *For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future* (Boston: Beacon Press, 1989). On the action front there are a host of organizations ready to channel your energy, from the Audubon Society and Natural Resources Defense Council to Greenpeace and Friends of the Earth. Also a number of specifically religious organizations devoted to environmental issues, some of which I will list in the Appendix.

own food supply and foul our own nest. And the situation could grow dramatically worse. If, for instance, the current Uruguay round of international-tariff negotiations should ever strike a fair trade bargain with the Third World (an unlikely event) and their economies started to produce and consume on even a fraction of the American scale, the planet would face immediate meltdown.

Yet our responsibility is clear. Let me put it to you this way: The goal of science, said Aristotle, is to "save the appearances" by theoretical means; what we face in today's ecological crisis is the challenge to save the appearances in a far more literal and practical sense. The Earth has cast its fate into our hands—and that fate is "the work of our hands" offered up in our liturgies. My guess is that neither Jesuits nor anyone else will accept responsibility for the state of the ecosystem until we are charmed into it willingly, until we begin to see and hear, in symbolic gesture and preaching, that caring for the Earth is what human work and technology are all about, and that there will be no redeeming ourselves without saving Earth. Mother Nature has plotted, conceived, and hatched us over billions of years—and what we have so abundantly received from her we must freely return, with a difference. We are nature's big chance to become spirited.

8. The Voice of the Thermal Howl

Let me return, then, to the background music and to Carl Sagan's appeal with which I began. All of nature, we said, is engaged in the work of transubstantiation. To see things this way puts us in a position to approach the distinctive way Christians have of infusing our planetary home with a vision of the sacred. *Hoc est corpus meum.* "This is my body. . . . This is my blood. . . ." I want to reflect on a meaning of that identification of "I" and "it" that we do not ordinarily bring out. Jesus takes a piece of Earth, at root a crystallization of buzzing atoms, and, pouring himself into it, makes something of it, turns it into metaphor. In simple outline, the action is utterly, starkly ordinary, a sample of the kind of technological transfiguration that

human beings have been performing ever since (and before) Abraham departed Ur in quest of a promised land. There's more to it, of course, since the rule we have just learned is that one never returns energy received in precisely the form in which it was given. As economists would say, one "adds value."

Now let me circle around those words, that simple yet arresting act of making metaphor, making something stand for what it had not stood for before. What does it mean to identify oneself with the Earth? Very glancingly, I referred above to the fact that the early Jesuits dwelt in a Ptolemaic world; that being so, it's a safe bet that they felt themselves subliminally linked to the planets, indeed to all the signs of the zodiac, and that the very seas, both sublunar and supercelestial, tided them inwardly. (Why was Ignatius wonder-struck, do you think, when he gazed up at the stars from a Roman rooftop? He not only saw stars, he heard the rush of the cosmic ocean above.) Okay, the Ptolemaic framework has been drained of its juice. But what of the sensibility, the sense of cosmic connection it expressed? If what I have surveyed in Section 6 is even approximately true, then the early Jesuits didn't know the half of it. The Newtonian interlude is over. Instead of shouting "I am not that!"—meaning that we are more than atoms blindly spinning, more than the chemistry in our bodies, more than the great ape or one of Pavlov's dogs—we have to acknowledge the other half of the truth, that "I am that" —star stuff, Earth stuff, a being literally conceived in far-off parts of the universe and seeded here on this planet. Christianity is not Platonism. "Remember," chants the Ash Wednesday ritual, "thou art dust." Star dust. Each one of us is a distillation, a condensed centrifuge of cosmic energy. We may leak like a sieve, but we dam up the whole sidereal river.

Communion lies at the heart of reality. "Ah," says Rilke,

> not to be cut off
> not through the slightest partition
> shut out from the law of the stars.
> The inner–what is it?
> If not intensified sky, hurled through with birds and deep with winds of homecoming.

Entranced by the Newtonian dream, there once was a time when we were tempted to believe that flights of imagination like this, notably Rilke's identification of mind with sky, were fanciful, the ravings of an intoxicated romantic. The poet's peculiar habit of saying I am rock, river, animal, and sky was taken for granted as a tolerable exaggeration, perhaps, but not taken very seriously. No more. In light of quantum physics and nonequilibrium thermodynamics, we have to say that such poetry is the most literal truth, confirmed, believe it or not, by all that physics and chemistry have been teaching us for the last 150 years. The taboo against identifying with nature has been lifted—by science itself. As Dr. Lewis Thomas is fond of pointing out, without our planet's horde of plant chloroplasts and the oxidating mitochondria in our cells, we could not breathe, move a muscle, think a thought.[44] I am that, you are that, we are that: "sheafs of times, bouquets of times," the final alchemists and interpreters, the voices of the hurricane. Yes, "intensified sky." Star time and Earth time speak through us; we are their seed, their sound. This is Earth's body, Earth's blood speaking.

The poets, the children who identify with what they see and hear, with all manner of the not-self, and who impersonate it, have it exactly right. As do the millions of naive Americans who subscribe to the new glossy science magazines or eagerly devour the Tuesday science section of the *New York Times*—as if they were tuning in, by way of black holes, supernovas and grand unification theories about the first milliseconds after the Big Bang, to something deeply mysterious within their own souls. Despite the disclaimers of many of the writers, they are. The stuff activates the human soul's potential to be all things. Nature is nothingness, said both Aristotle and Aquinas, until it is filtered through the human imagination, until it is dreamt into being meaningful, rather than nightmare, rather than a holocaust.

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[44] Lewis Thomas, *The Lives of a Cell: Notes of a Biology Watcher* (New York: Bantam, 1975), 2ff.

"I am that"—the voice of the thermal howl. It is a refrain that the Navajo understands, to which any Hindu would readily assent. It is also, I think, something that any Christian should understand—remembering how Jesus of Nazareth willingly emptied himself, willingly identified with Earth in the form of bread and wine and then changed it utterly. His life is parable for what that means, for what the Earth shall mean if we will. "Do this," he said, "in memory of me."

To say "Hoc est corpus meum" incorporates the playful "mother's mind" or "celestial light" that a Wordsworth responded to in meadow, grove, and stream. It also includes what the primitive animist and the pantheist want to say about what is communicated to them through their communion with nature. Yet it is also different, a transfiguration of these rich meanings. It is different in the way in which good metaphor never represents a monism in which all cats are gray. No, the spice, the shock in a sharp metaphor relies on the union, the identity asserted, between two things in their full integrity that are not the same. As in the Council of Chalcedon's "two natures in one and only Christ," unconfused and unalloyed even as they are undivided and not contrasted by domain or function. Likewise, if "I am that," identical with nature without remainder, it would equivalently mean that I was no longer a conscious individual, that my original oceanic immersion in nature had taken over; and hence, like the heroes of the *Iliad* or many parts of the Old Testament, instead of an "I" standing on my own two feet and thinking for myself, you would have a mere spellbound puppet of the gods, mere plaything of compulsive fear and animosity. It would be like renouncing nature's very gift, that all her metamorphoses had worked, except for this last one, the one that was seeded here to say what fifteen billion years meant. To say of the Earth, "This is my body," is distinguished as the free act of one who is no longer compelled by hormones or hyperthyroid states to make such an identification. It is to utter the paradox: At one and the same time, I am and am not that—a fine metaphor, a coincidence of opposites.

Too many deep ecologists and popular gurus do not get the point that differentiating God and ourselves from nature was the way in which our ancestors won their freedom. They fail to see that you have to separate from nature (and Mom and Pop) in order to reunite willingly, compassionately, as a free creature. When Shirley MacLaine proclaims "All is one" and "I am God," we justifiably get nervous. And when certain environmentalists urge us to revert to the religion of the Great Goddess or take out our drums and hire a Native American shaman, I think they fail to understand the underlying psychological reason for the Hebrew prophets' campaign against the "temples dim" of Canaanite nature religion. They forget how much ancient Mediterranean religion (and Meso-American religion as well) was a matter of sacrificial scapegoating and headhunting, exactly why ancient atomists like Democritus and Lucretius proposed to displace the bloodthirsty gods with the pacifying study of physics.

Hoc est—this is a specifically human signal. And, after Adam's fall into wearing clothes, humanization begins here. It is not the blink of an atom, nor is it an animal signal to another animal that goes "I am large and strong and will dominate you" or the reverse, "You are bigger and I will beg." No, this is not the politics of master/slave relations. It says, Whoever I am, whoever you are, this is some bread, independent of me, independent of you. Neuter. It is not defined by my relation to it, by the fact that I (or my family, tribe, caste) own the field of grain from which it derives, the bakery chain that made it—and therefore I am the stronger, the dominant figure—or vice versa, that you own the field, that you control the manufacture and set the terms of the exchange. No, this is bread; the object is an object for both of us and anyone else, on equal terms. In effect, we hold it in common. This, I would say, is the strategy of differentiation and objectification that began with Abraham's departure from Ur. If you have ever traveled in India, an oral culture where everything is defined in personal terms—in relationship to family, tribe, and caste that define positions of dominance and servility on a strict and fixed hierarchical scale—you will recognize the value of the discovery of the object in human affairs. Indeed, in

astrophysical affairs. It is, of course, the preliminary condition for scientific inquiry. More significantly, it gives one the chance to discover neutral terrain, and thus to escape the network of personal relations that pit one group against another in a battle for supremacy. To utter *Hoc est* is to establish neutral ground, an objective world that is neither thine nor mine, but a kind of planetary commons.[45]

Breaking away from our totally symbiotic relationship to nature, then, was a necessary first step toward our true work on this planet. Learning to stand our ground, to think and dream—not for ourselves, but for Earth's sake—we learn to transform energy in a purposive way, to give it back in a form (the artifact called culture) different from the form in which the world of cloud and tide, algae and rain forest, and fertile plain transmitted Sun and Moon energy to us. This is also the stance necessary for committing a sacrament—as in extracting fossil deposits, ore and silicon, and turning them into a sign that is promising, that contributes to a common good, that gives grace. Sacraments, signs that give grace, are not meant to be confined inside churches; they are meant for the outdoors, the public square.

9. Making Sacrament of Earth

Like the rest of never-spent nature, we are here to give a sign, if you will, a high sign. This entails more than expressing the little, private personality. It is a collective thing, carried out through those combinations we call institutions: government, law, school, transnational corporation, church.[46] The sign we collectively give, that is to say, is matter for public policy. Policy for the Earth. The Earth, or what we as a species make out of Earth, is our sign. We are here in a shared project to move

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[45] See Serres, 122f.

[46] The critical issues in making these institutions work for the planet and as an expression of our values are treated in the team effort of Robert N. Bellah, Richard Madsen, William M. Sullivan, Ann Swidler and Steven M. Tipton, *The Good Society* (New York: Knopf, 1991).

mountains, to make metaphor of Earth. It is a poet's work, the poet-maker in every bureaucratic bone of us.

Inevitably, we leave our graffiti scrawl, our stamp, our mark, upon the planet during our brief passage here. How will our collective signature read? What sign will we choose to give, promise or curse? These are questions that pertain to the vision (or lack of it) behind our use of technology. The question of our technology, in other words, is the question of what we are to make of the Earth—and that, I am saying, concerns the issue of sacrament. The Eucharist, being our central sacramental sign, signals the Primal Poet's intent to seed the Earth with an energy called hope and charity, which awaken the dead. It expresses the visionary aim, the great metaphor, to which all our technological transformations are to be consecrated: They are to spread out a great meal to which all are invited, after six days of creative work, to take their ease—to rest as the Creator did on the seventh day and to say, "It is very good."

Carl Sagan didn't put it that way, but he was reaching for the same point at the close of his "Cosmos" series. He tried to heighten our sense of responsibility to the cosmos, above all to the planet, by asking us to meditate on our place in the order of transformations that preceded us. If we imagine ourselves situated at the end of the old cosmic year, watching the countdown in seconds until the new cosmic year breaks, what will we choose to welcome? For the planet's sake, what will we make of this New Year? For "despite the insignificance of the instant we have so far occupied in cosmic time," Sagan wrote, "it is clear that what happens on and near Earth at the beginning of the second cosmic year will depend very much on the scientific wisdom and the distinctly human sensitivity of mankind."[47]

I want to put it somewhat differently. Is the vast universe in which we dwell, as the French biologist Jacques Monod would have it, deaf to our music, indifferent to our hopes, our suffering, even our crimes? Does the nightmare of history, the cries of

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[47] *Dragons of Eden*, 17.

Auschwitz and Hiroshima, not count, not set the stars to weeping? Now I think one's answer to that will depend on whether you are in touch with your own soul, that cavern in you where all the currents of the cosmos intersect and meet. Sunk in your body-temple, operating through your sympathetic nervous system, your soul is the basic depth probe or antenna—better than any electron microscope or nuclear accelerator—through which you listen to the thermal howl, the microbes that swim in your cells, the restoration of humble blue-green algae, ancient forests now buried under the Earth, the wildlife with whom you are kin. Do you not hear the entire creation groaning, groaning in one great act of giving birth? And do you not hear the appeal, the request that Earth makes of us? Can you not read Earth's silent sign language?

"Why, if this interval of being can be spent serenely / in the form of a laurel," asks Rilke in "The Ninth Duino Elegy,"[48] ". . . why then / have to be human—and escaping from fate, / keep longing for fate?" Oh, it is not because happiness exists, or out of curiosity or to improve ourselves, he answers,

> But because **truly** being here is so much; because everything here
> apparently needs us, this fleeting world, which in some strange way
> keeps calling to us. Us the most fleeting of all.
> **Once** for each thing. Just once; no more. And we too,
> just once. And never again. But to have been
> this once, completely, even if only once:
> to have been one with the earth, seems beyond undoing.

We are up to our neck in debt. Do you not hear the stars, quarks, rain forests, and whooping cranes calling out to you to name them properly, to give them voice, to put heart into them by what you make of them? "To say them," as Rilke puts it,

> oh to say them **more** intensely than the Things themselves
> ever dreamt of existing. Isn't the secret intent

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[48] Stephen Mitchell, ed. and trans., *The Enlightened Heart: Anthology of Sacred Poetry* (New York: Harper & Row, 1989), 140–43.

> of this taciturn Earth, when it forces two lovers together,
> that inside their boundless emotion all things may shudder with joy?

Isn't that what we're here for—the secret mission of the scientist's inquiries, the homemaker's labor, the builders of cities? To pour soul into the soulless, into the chaos of nature, and make all creation "shudder with joy," as the Creator-Poet did on the first day?

As I read the import of the new physics and cosmology, they bring to the fore an eschatological question. They place us in a radically unfinished universe, where it is our task to bring things to completion, to give them rest and a feast to show for all their labor. We owe this diligent, unfinished world deliverance from absurdity. And we do that by freely letting it enter our hearts, by freely claiming it as our body and blood. Again, it seems to me that Rilke has it mostly right: To deliver the Earth from absurdity involves making a good story of our passage here, telling "the unsayable one" (or at least an impressionable angel) of "things." It would amount to a psalm.

> Praise this world to an angel, not the unsayable one,
> you can't impress **him** with glorious emotion. . . .
> . . . So show him
> something simple, which, formed over generations,
> lives as our own, near at hand and within our gaze.
> Tell him of Things. He will be astonished. . . .
> . . . And these Things,
> which live by perishing, know you are praising them; transient,
> they look to us for deliverance: us, the most transient of all.
> They want us to change them, utterly, in our invisible heart,
> within—oh endlessly—within us! Whoever we may be at last.
> Earth, isn't this what you want: to arise within us,
> **invisible?** Isn't that your dream
> to be wholly invisible someday?—O Earth invisible!
> What, if not transformation, is your urgent command?
> Earth, my dearest, I will . . .
> Unspeakably I have belonged to you, from the first.[49]

[49] Mitchell, 142.

Appendix

Religious Environmental Groups

The Center for Reflection on the Second Law, 8420 Camellia Dr., Raleigh, NC 27613

Center of Concern, 3700 13th St. N.E., Washington, DC 20017

Eco-Justice Project Network, Center for Religion, Ethics and Social Policy, Anabel Taylor Hall, Cornell University, Ithaca, NY 14853 (Publishes *The Egg.*)

Eco-Justice Working Group, National Council of Churches, Prophetic Justice Unit, Rm. 572, 475 Riverside Drive, New York, NY 10115

Institute in Culture and Creation Spirituality, Holy Names College, 3500 Mountain Blvd., Oakland, Ca 94619 (Matthew Fox's group, it publishes *Creation* magazine.)

Interfaith Center on Corporate Responsibility, 475 Riverside Drive, Rm. 566, New York, NY 10115. (Publishes *The Corporate Examiner.*)

Interfaith Coalition on Energy, P.O. Box 26577, Philadelphia, PA 19141, [215] 635-1122 (Publishes *ICE Melter Newsletter.*)

Justice, Peace, and Integrity of Creation, World Council of Churches, P.O. Box 2100, CH-1211, Geneva 2, Switzerland

The Land Stewardship Council of North Carolina, Rte. 4, Box 426, Pittsboro, NC 27312

Land Stewardship Project, 14758 Ostlund Trail North, Marine, MN 55047 (Publishes *Land Stewardship Letter.*)

The National Catholic Rural Life Conference: 4625 Beaver Ave., Des Moines, IA 50310, [515] 270-2634. (Publishes *Earth Matters and Common Ground.*)

The North American Conference on Christianity and Ecology, P.O. Box 14305, San Francisco, CA 94114 (Publishes *Firmament.*)

Riverdale Center of Religious Research (Thomas Berry), 5801 Palisade Ave., Riverdale, NY 10471, [212] 584-1182

General Environmental Organizations

Council on Economic Priorities, 30 Irving Place, New York, NY 10022, [212] 420-1133

Environmental Action Foundation, 1525 New Hampshire Ave. N.W., Washington, DC 20036, [202] 745-4870

Environmental Protection Agency, Public Information Center, 401 M St. S.W., Washington, DC 20460, [202] 382-2080

Friends of the Earth, 218 D Street S.E., Washington, DC 20003, [202] 544-2600

Global Tomorrow Coalition, 1325 G Street N.W., Suite 915, Washington, DC 2005, [202] 628-4016

Greenpeace USA, 1426 U St. N.W., Washington, DC 20036, [202] 462-1177

Inform, 381 Park Ave. South, New York, NY 10060, [212] 689-4040

Izaak Walton Club, 1701 N. Ft. Myer Drive #1100, Arlington, VA 22209, [703] 528-1818

The Nature Conservancy, 1815 North Lynn St., Arlington, VA 22209

Rocky Mountain Institute, 1739 Snowmass Creek Rd., Snowmass, CO 81654-9199, [303] 927-3128

Seventh Generation, 126 Intervale Rd., Burlington, VT 05401, [802] 862-2999

Sierra Club, 730 Polk St., San Francisco, CA 94109, [415] 776-2211

Union of Concerned Scientists, 26 Church St., Cambridge, MA 02238, [617] 547-5552

United Nations Environmental Programme, DC2-0803 United Nations, New York, NY 10017, [212] 968-8093

Worldwatch Institute, 1776 Massachusetts Ave. N.W., Washington, DC 20036, [202] 452-1999

World Resources Institute, 1709 New York Ave. N.W., Washington, DC 20006, [202] 638-6300

World Wildlife Fund, 1250 24th St. N.W., Washington DC 20037, [202] 293-4800

LETTERS TO THE EDITOR

Editor:

I would like to protest against the unbalanced activism being promoted by various papers published in *Studies*. For instance, they brush aside tertianship and other means to deepen ". . . solid and perfect virtues. . . . For they are the interior gifts which make those exterior means effective toward the end which is sought." They regard these as monastic practices inconsistent with our apostolic vocation.

Or those who carefully cite St. Ignatius's insistence that an hour and a half of prayer was enough for scholastics, as if that amount were his ideal for all Jesuits. They very carefully pass over in silence Ignatius's own practice as if it were irrelevant. But Ignatius was very conscious of his responsibility as a founder, and of his obligation to give an example for the other members of the Society. Yet, busy as he was as general, St. Ignatius spent at least five **hours** daily in personal prayer. Count them: one hour for Mass, plus another two hours in prayer afterwards. His breviary had been commuted to a rosary, but it took him as long to say the rosary as it would have taken to pray the breviary—probably another hour and a half. Half an hour for the two examinations of conscience, plus points for meditation, and scheduled recollection every hour on the hour.

Is our spiritual vitality so much stronger than St. Ignatius's that we need only one-third or one-fourth of the time in daily contact with God that he considered necessary to maintain his?

Francis J. Ring, S.J.
St. Peter Claver Church
Punta Gorda, Belize

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Editor:

I found very worthwhile the essay by Frank J. Houdek, S.J., entitled "The Road Too Often Traveled: Formation: Developing the Apostolic Body of the Society," in the January 1991 *Studies*. His questions regarding admissions to each stage of formation, especially entrance and vows, for example, coincide with my own views over years as a member of our formation team.

New to me was his wonder about the place of the Spiritual Exercises of thirty days during tertianship. His conclusion about a person with "some gift of non-

discursive prayer," which suggested that "[i]n such a case, the Exercises would, in fact, be counterproductive for the spiritual growth of the individual," made me stop and think.

Where, I asked myself, in the tradition of the Society of Jesus or in that of the religious communities of men and women whose gift in the Church is also founded on the Exercises has there been precedent for considering that the full Exercises are only for people who have **not** "grown in prayer to some gift of non-discursive prayer"? When is there ever a time when persons in their prayer life are beyond receiving in prayer the life-giving, sustaining love of God anew, are beyond considering the Principle and Foundation of all created life on this planet, are beyond prayer over the Mysteries of the life of Jesus, are beyond contemplation to obtain divine love? If all prayer is done after the manner of the pray-er and all grace received in the same way, is there any type of advanced pray-er, all other considerations for a long retreat being equal, for whom the dynamic of the thirty-day Exercises is not suitable?

On the other hand, I did reflect on the fact that the thirty-day retreat is a specifically constructed "journey" with a beginning, a middle, and an end; and that a person who is in the prayer of quiet is by nature not "moving from beginning to end," so to speak, in prayer time. There may then be room to consider Fr. Houdek's thesis, which prompted me toward some research into our own tradition.

Founded in Spain in 1877 and grounded in Ignatian spirituality (alone) from their foundations, the Handmaids of the Sacred Heart (presently 1,750 women of twenty-two nationalities on five continents and India) have always done the thirty-day Exercises before final profession. The first experience was made by our cofoundresses, St. Raphaela Mary Porras and her sister Dolores, with the original eight other religious. Our first tertianship was instituted in 1898 in Rome; and from that day to the present more than 2,500 of our members have done the Spiritual Exercises of thirty days as an integral part of our international seven months' tertianship, recently as individually directed Exercises.

I cannot speak for the state of prayer of any of the 2,500 sisters except for our two cofoundresses, who testify to the value of the thirty-day retreat by their personal relish for it, as well as by their determination to legislate the event into our constitutions as part of tertianship. The constitutions have been revised with each revision of canon law; and at each general congregation in which discussion of the matter and form of tertianship arose, the thirty-day retreat was preserved. (Since the 1983 revision of our constitutions, we

also place the long retreat as the fundamental identity/vocation discernment experience of the novitiate, the basic experience that orients our following of Christ).

Recently I did a random survey of seventeen sisters born in six different countries but all members of the USA Province who from 1938 to 1991 did a tertianship, for a sampling of brief responses to the experience of the thirty-day retreat. Four had an unsatisfactory experience of tertianship and/or of the thirty-day retreat because of a language barrier or a poor retreat-giver. The others, each in her own way, agreed that the retreat was immensely valuable personally and apostolically, an experience of God and of Jesus. I also asked the question, "In general, would you keep the thirty-day retreat in tertianship?" Seventeen sisters answered yes; several qualified their answer. Two expressed a wonder similar to Fr. Houdek's; namely, whether the long retreat should be repeated.

Thank you for the challenge to thought and reflection offered by *Studies in the Spirituality of Jesuits.*

Kathleenjoy Cooper, acj
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Editor:

I enjoyed the monograph by Father Frank Houdek on formation in the Society. As usual, Frank opens up our Jesuit heritage and applies that historical reflection to contemporary life. A case in point is his reflections on tertianship. This phase in formation in the Society seems to have evolved differently than what was experienced by the very early Jesuits.

Frank writes that the Society's contemporary experience of tertianship may be too narrow in form and content to meet the needs of contemporary Jesuits. This may be the case for some Jesuits. Nevertheless, I want to say that the tertianship I and eleven other Jesuits made over two summers through the Wisconsin Province was an excellent experience for each of us.

We twelve tertians represented the apostolates of higher and secondary education, overseas mission, native-American ministry, and formation. We enjoyed two summers of supportive and challenging peer companionship, the competent accompaniment of spiritual directors, and enlightening input on the Constitutions and the history of the Society. As a result of the Spiritual Exercises, each of us was intimately touched by the Lord in ways we wanted, and sometimes in ways we did not know we needed. The resistance to tertianship on the part of some of our number may have been the unconscious resistance to change that tertianship can threaten.

Doing the Spiritual Exercises after some years of professional life

and ministry proved to be life-giving in ways unique to each of us. To a man, we enjoyed the first opportunity since novitiate days to engage in an ordered study of the Constitutions, documents of the general congregations, and Jesuit history. This helped deepen our gratitude and pride in being Jesuits.

There are many styles of tertianship. Those Jesuits I've talked to who did other styles of tertianship attest to the fact that their lives were changed and deepened by the experience. The elements of tertianship that seem to be most beneficial are the companionship formed among the tertians and their directors, the experience of the Spiritual Exercises, the study of the Society and its documents, and the various ministries undertaken during the tertianship.

I am in favor of being as flexible as we can with tertianship, while taking care to ensure that our young men not lose what happens to them as a result of a good tertianship program.

Julio Giulietti, S.J.
Georgetown University
Washington, DC

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Jules J. Toner, S.J.

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Jules J. Toner, S.J., has for many years been engaged in spiritual counseling and directing retreats in addition to teaching philosophy. He has increasingly devoted much time to research and lecturing on Ignatian spiritual discernment. Among the results of those labors have been books and articles on various aspects of that subject, including his earlier book, also published by the Institute of Jesuit Sources, A Commentary on Saint Ignatius' Rules for the Discernment of Spirits.

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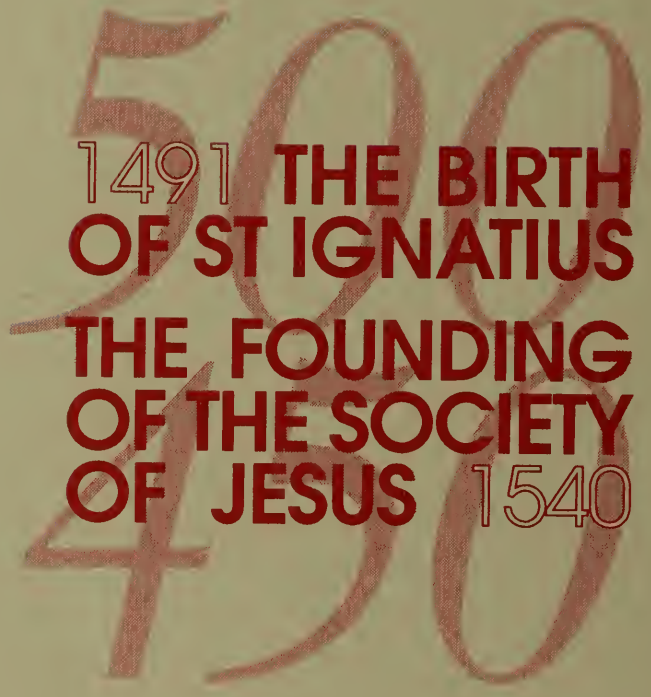

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